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New records of *Utricularia* (Lentibulariaceae) for the state of Maranhão, Brazil

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Abstract

We report the first records of *Utricularia cutleri* Steyerm. and *U. resupinata* B.D.Greene ex Bigelow from Maranhão, northeastern Brazil. These species were collected in Lençóis Maranhenses National Park. This study adds new information on the flora of Maranhão and extends the distribution of these species in Brazil.

Keywords

Geographic distribution, new occurrences, northeastern Brazil, PARNA Lençóis Maranhenses, taxonomy.

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Introduction

The state of Maranhão in northeastern Brazil covers an area of 329.642 km^2 (IBGE 2014), which includes parts of three different domains: the Cerrado (64.8%), with its different phytophysiognomies ranging from open fields to closed-canopy forests; the Amazon (34.8%), with its characteristic vegetation of tall trees, floodplain forests on periodically flooded plains, and permanently flooded igapó forests; and a small portion of Caatinga (1.1%), characterized by the presence of shrubby vegetation with twisted branches and deep roots (Spinelli-Araújo et al. 2016). The state also contains at the confluence of the three domains a transition zone from the semi-arid climate of the interior of northeastern Brazil to the equatorial wetlands of the Amazon, and there is also a vast area under maritime influence, which further contributes to the wide diversity of landscapes (Maranhão 2011).

The Lençóis Maranhenses National Park (PNLM), created by Federal Decree No. 86.060 of 6/2/1981, is in the northeastern region of the country, on the eastern coast of Maranhão state (Instituto Chico Mendes 2019). The park has an area of 155,000 ha, lies within the Cerrado domain, between 02°19′S to 02°45′S and 042°44′W to 043°29′W. It includes portions of the municipalities of Barreirinhas (44.86%), Santo Amaro (42.15%), and Primeira Cruz (6.89%). The landscape of the park has a gently undulating relief of below 100 m, with dune fields and "restinga" vegetation. The climate is equatorial according to the Köppen classification, with six dry months and six rainy months. The mean annual temperature is relatively high, reaching around 28.5 °C and with an annual mean temperature of 1.1 °C with no significant oscillations. The total annual precipitation varies from 1473 mm to 1623 mm, with the wettest period in March and April (Castro and Piorski 2002).

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Lentibulariaceae is a family of asterid eudicotyledons positioned in Lamiales (Stevens 2017). The family includes carnivorous herbs, has a cosmopolitan distribution, and is composed of approximately 360 species divided into three genera: *Utricularia* L., *Genlisea* A.St.-Hil., and *Pinguicula* L. (Jobson et al. 2003; Müller et al. 2004). Only the first two genera occur in Brazil, where 84 species are recorded, 18 in *Genlisea*, including 11 endemics, and 67 in *Utricularia*, including 18 endemics. The Cerrado is richest in number of species, with about 70% of the taxa occurring in this domain (Flora of Brazil 2020).

Utricularia, commonly called bladderworts, is the largest genus in the family, comprising about 240 species. The genus has a cosmopolitan distribution, with the main center of diversity in the Neotropical region (Silva et al. 2018). In Brazil, members of the genus occur in all five phytogeographic domains, with 13 species recorded so far from the state of Maranhão (Flora of Brazil 2020).

The genus *Utricularia* can be recognized as generally small and delicate, annual or perennial herbs, usually aquatic or terrestrial on moist soils. The plants lack true roots and may have modified branches that function as roots (rhizoids); the stems are usually stoloniferous; the leaves may be entire or branched, and utricle-like traps (leaves modified to capture prey) are present on the branches, leaves and/or rhizoids; the inflorescences are racemous, erect, sometimes endowed with structures that become "floats" in some aquatic species; there are peltate, subpeltate, or basifix bracts with entire to denticulate, laciniate, or fimbriate margins; the calyx has two (subgen. *Utricularia* and subgen. *Bivalvaria*) or four (subgen. *Polypompholyx*) sepals, the corolla is bilabiate, spurred, with or without a gibbous palate, and the lower lip is usually larger than the upper lip, which may be entire, crenate, bilobed or trilobed (Taylor 1989).

Recently, Rodrigues et al. (2019) reported two species of *Utricularia* new to Maranhão, *Utricularia benjaminiana* Oliv. and *U. myriocista* A.St.-Hil. and Girard., which increased to 15 the number of species known from the state.

Our floristic studies in the Lençóis Maranhenses National Park add two additional species of *Utricularia*, *Utricularia cutleri* Steyerm. and *U. resupinata* B.D.Greene ex Bigelow, to the flora of Maranhão. These new records are described here.

Methods

Our study was based on field collections, a literature review (Taylor 1989; Guedes et al. 2018, 2019; Mota and Zappi 2018; Flora of Brazil 2020), and reviews of digital collections in Reflora databases (http://reflora.jbrj.gov.br; accessed on: 2019-7-2) and SpeciesLink (http://www.splink.org.br/; accessed on: 2019-7-2). Type specimens were consulted through the digital collections of Reflora database (MO herbarium) and P herbarium (acronyms according to Thiers 2018). Identifications were confirmed by consulting Taylor's (1989) monograph of the genus and the protologues of the taxa. The descriptions are based on the collected samples, using the terminology adopted by Taylor (1989). The exsiccatae of the new records were incorporated into the Maranhão Continental Herbarium (BMA), in the Department of Natural Sciences–Biology, Federal University of Maranhão, Bacabal campus. Duplicates were sent to the Universidade de São Paulo Herbarium (SPF).

Results

Utricularia cutleri **Steyerm.**, Bull. Torrey Bot. Club 79: 311. 1952.
Figures 1, 2A, B

Type: *Cutler 8363* (isotype: photo MO!), Ceará, Brazil, 1945.

New records. Brazil: Maranhão • Barreirinhas, circuito Lagoa Azul, 02°39′32″S, 042°50′23″W, 14.VIII.2018, *M. Salazar-Ferreira 009 et al.* (BMA, SPF) • Canto do Atins, 02°35′50″S, 042°48′31″W, 15.VIII.2018 (fl.), *M. Salazar-Ferreira 039 et al.* (BMA, SPF) • Mata-Fome, 02°37′47″S, 042°48′30″W, 15.VIII.2018 (fl.), *M. Salazar-Ferreira 033 et al.* (BMA, SPF) • Espigão, segundo poço da Petrobrás, mata de galeria, 16.VIII.2018 (fl.), *M. Salazar-Ferreira 036 et al.* (BMA, SPF).

Identification. Terrestrial, 0.8–1.1 cm tall, glandulouse. Stolons c. 4.4 cm long, c. 0.2 mm wide, terete. Leaves simple, with capillary segments, c. 5.8 mm long. Traps stalked lateral on leaves, c. 0.4 mm long, ovoid, covered by glandular trichomes, no external appendages, doorway or entrance lateral. Inflorescence with 1–5 flowers, erect; scape green, with dark brown, viscous glands in the upper half, terete. Scales present, similar to bracts; bracts subpeltate; bracteoles absent. Pedicel erect, filiform, terete, with viscous glands. Calyx with sepals equal, ovoid, 1.8–2.3 mm long, margins entire, viscid-glandular, apices acute. Corolla white, with a yellow palate and a purple blotch at base of upper lip; upper lip triangular, with margins reflexed and apex emarginate; lower lip quadrate, with margins crenate and apex truncate. Spur conical, longer than lower lip, slightly curved, apex acute. Ovary ovoid, glandular, style distinct; stigma circular.

Utricularia resupinata **B.D.Greene ex Bigelow**, Fl. Bost., ed. 3: 10. 1840.
Figures 1, 2C, 2D

Type: *B.D. Greene s.n.* (isotype: photo P!), Massachusetts, USA, 1829.

New records. Brazil: Maranhão • Barreirinhas, rio Negro region, Baixa Grande, 02°31′45″S, 043°00′28″W, 15.VIII.2018 (fl.), *M. Salazar-Ferreira 016 et al.* (BMA, SPF).

Identification. Terrestrial, 4.3–4.5 cm tall. Leaves simple, cylindrical, articulated, 1.3–1.8 cm long, c. 0.3 mm wide. Traps stalked lateral on the leaves and on the stolons, c. 0.6 mm long, obliquely ovoid, dimorphic,

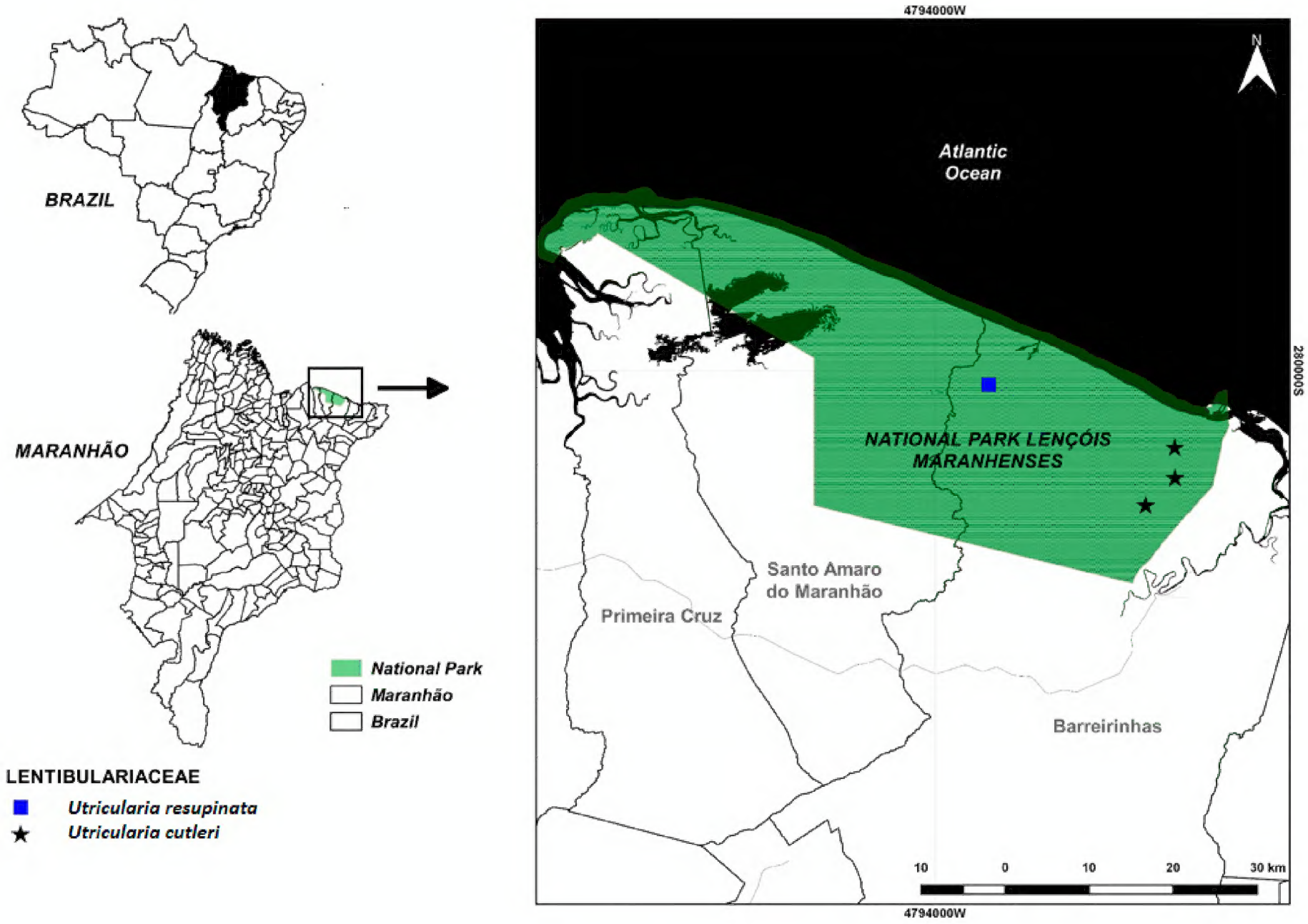

Figure 1. Lençóis Maranhenses National Park in the state of Maranhão and Brazil (left) and the new records of *Urticularia resupinata* and *U. cutleri* (right).

Figure 2. *Utricularia* in Lençóis Maranhenses National Park. **A, B.** *U. cutleri*: (A) habit; (B) detail of the quadrate lower corolla lip. **C, D.** *U. resupinata*: (C) habitat; (D) detail of the resupinate lower corolla lip. (Photos: Elidio Guarçoni).

doorway or entrance lateral, smaller traps without external appendages and larger traps with two recurved, branched, dorsal appendages. Inflorescence reduced to a solitary flower, erect; scape vinous, glabrous, terete. Scales absent; bracts basifixed, tubular, c. 0.8 mm long, apex bilobed; bracteoles absent. Pedicel erect, filiform, terete. Calyx with sepals equal, ovoid, c. 1.7 × 1.2 mm, margins entire, convex, apices acute. Corolla rose pink, c. 8.6 mm long; upper lip narrowly obovate, apex rounded or retuse; lower lip resupinate, 3-crenate, apex truncate; spur ascending, cylindrical, c. 6.2 mm long, shorter than lower lip, apex emarginate. Ovary ovoid, style distinct; stigma elliptical, densely glandulose.

Discussion

Utricularia cutleri belongs to *U.* sect. *Sprucea*. Among other morphological characteristics, it can be recognized by the sticky viscosity produced by glands located on the scapes and pedicels; the subpeltate bracts and scales with irregularly toothed margins; a relatively large corolla compared to the sister taxa; the triangular upper corolla lip, with strongly reflexed margins and an emarginate apex; the quadrate and emarginate lower corolla lip; and a spur that is longer than the lower lip compared to the sister taxa (Guedes et al. 2019). *Utricularia cutleri* has recently been reestablished and differs from *U. viscosa* by a combination of macro- and micromorphological characters (Guedes et al. 2019). This species is endemic to Brazil, occurring in Ceará, Rio Grande do Norte, and Mato Grosso; it is reported here for the first time in Maranhão. In this state, *U. cutleri* was collected in the PNLM both in humid terrestrial environments and in small seasonal lagoons. When in wet areas, the plants bore only one flower, while those plants in the small lagoons produced multiflowered inflorescences. A comparison with the species' description by Guedes et al. (2019) shows that plants in the Lençóis Maranhenses population have shorter but wider leaves (5.8 × 0.7 mm vs 6–10 × 0.1 mm) and smaller utricles (0.4 vs 1 mm). In addition, plants of the Lençóis Maranhenses population bore inflorescences with 1–5 flowers (vs up to 10 flowers) and a white corolla (vs pale lilac).

Utricularia resupinata belongs to *U.* sect. *Lecticula*, whose members are characterized by their tubular bracts. Besides that, this species is easily recognized by its simple, cylindrical, articulated leaves and its rose pink corolla with resupinate lower lip. It is similar to *U. spruceana*, which occurs in Venezuela and in the Brazilian states of Amazonas and Pará (Taylor 1989; Flora of Brazil 2020), but it differs in possessing simple articulated leaves (vs dichotomously forked leaves). *Utricularia resupinata* occurs in North, Central, and South America (Taylor 1989), and in Brazil it was previously reported from Amazonas, Ceará, Rio Grande do Norte, and Sergipe (Guedes et al 2018; Flora of Brazil 2020). In Maranhão, *U. resupinata* was collected in the PNLM in a humid terrestrial habitats with riparian vegetation on the sandy banks of the Rio Negro.

Our results increase by two the number of *Utricularia* species recorded from Maranhão to 17. The new records presented here emphasize the lack of data on the occurrence of herbaceous species in this state, as pointed out by Guedes et al. (2018). Guarçoni et al. (2018) and Gomes et al. (2019) also mentioned the lack of data for the families Bromeliaceae and Fabaceae, respectively, in Maranhão.

The new records expand the areas of occurrence of these species, which have different distribution patterns. *Utricularia resupinata* occur along the eastern portion of North America, Central America and extending to Brazil where it is cited to Amazonas, Rio Grande do Norte, Sergipe and Ceará (Taylor 1989; Guedes et al. 2018), where inhabits shallow water environments of seasonal white-sand wetlands at low altitude, such as the ''campinaranas'' in Amazonas state and the coastal plains in the Northeast Region (Guedes et al. 2018). Already *U. cutleri* occor in restinga areas in northeastern Brazil, Ceará and Rio Grande do Norte, in areas seasonally flooded coastal plains, and in the Mato Grosso state, constituting a highly isolated population, where grows, mainly, on sandy quartzitic soil (Guedes et al. 2019).

They have in common their occurrence on the coast of the northeast region of Brazil, in restinga areas. These distribution patterns can be explained by seed dispersal by migratory birds, which commonly visit lacustrine habitats. The seeds of these plants settle in the mud and are carried on the birds' legs to new areas (Taylor 1989).

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Authors' Contributions

All authors contributed to the study conception and design. Preparation of materials, data collection, and analysis were performed by MSF, PMG, and EAEG. The first draft of the manuscript was written by MSF, and all authors commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

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